A Water Quality Assessment of Representative Trout Streams on Minnesota's North Shore of Lake Superior

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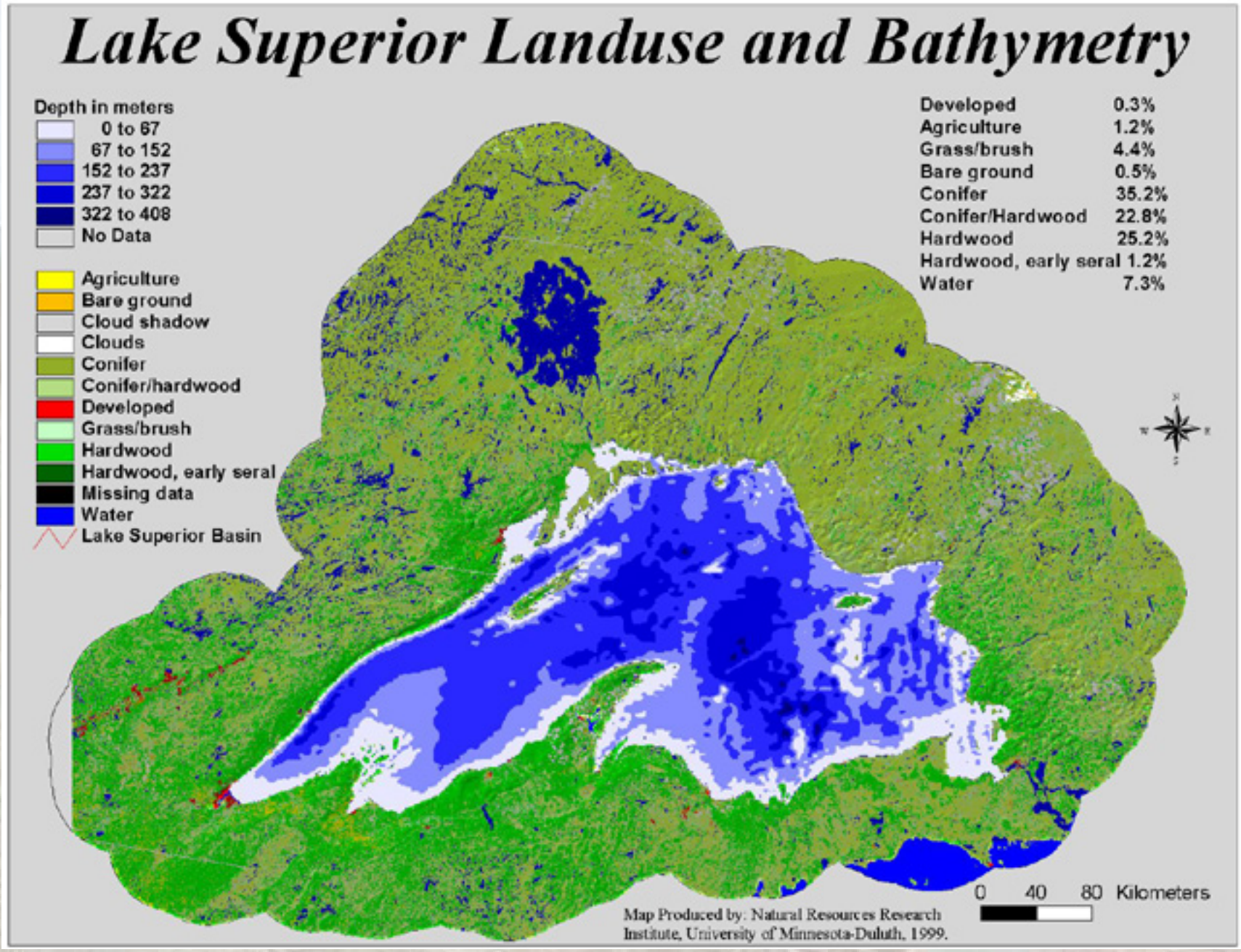
Lake Superior Landuse and Bathymetry



The North Shore is Changing

Cumulative

Impacts ??

Data / Information Need

- Resource agencies are lacking the data to effectively:
  - Assess current water quality conditions
  - Detect trends over time
  - Assist in stream protection / remediation efforts
- 2 of 27 streams have streamflow data
- Last comprehensive water quality study done in 1970’s

Tourism, Development, and Water Quality on the North Shore

- Tourism a major sector of our economy
  - $275 Million spent (2000) in the North Shore Area
- Tourism, Population, Development Steadily Increasing
- Tourism Closely Tied to the Quality of the Natural Environment (Lake Superior, Streams, Inland Lakes)

- **MPCA and cooperators asked**

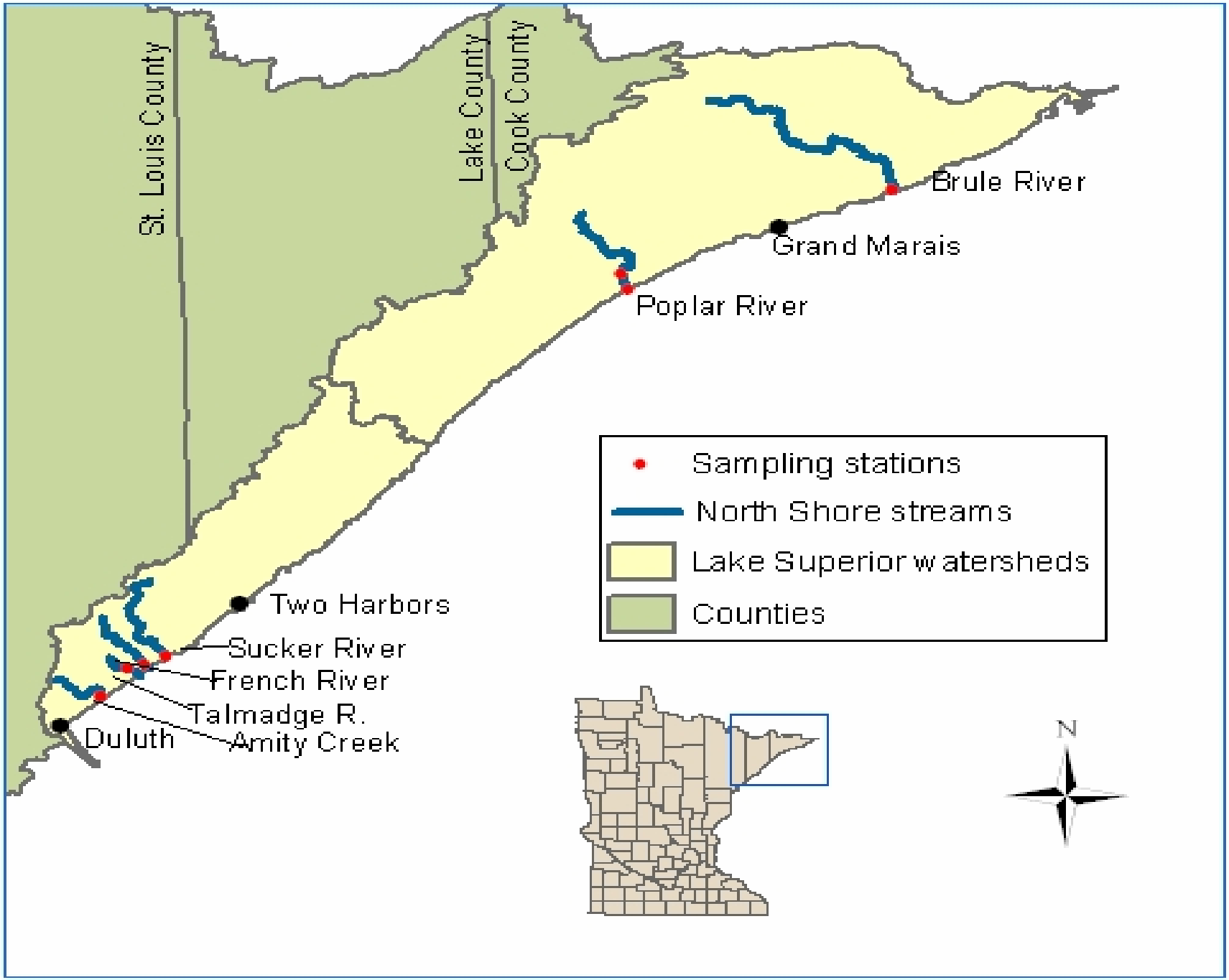
“ What is the condition of north shore streams, given our changing landscape?”

The North Shore Streams

- Dynamic Hydrology (i.e. flashy)
- Support Cold / Cool Water Fisheries
- Steep Slopes
- Thin, highly erodible clay soils
- **Minor increases in pollution can cause perceptible declines in water quality**

Site Selection

- 27 Minnesota Streams Flow into Lake Superior
- Representative Streams Studied
  - More developed: Duluth – Two Harbors
  - Less developed: Two Harbors to Grand Portage
  - Designated Trout Streams
  - Variations in drainage size, characteristics
  - Site close to watershed outlet
  - Safe, cost effective monitoring

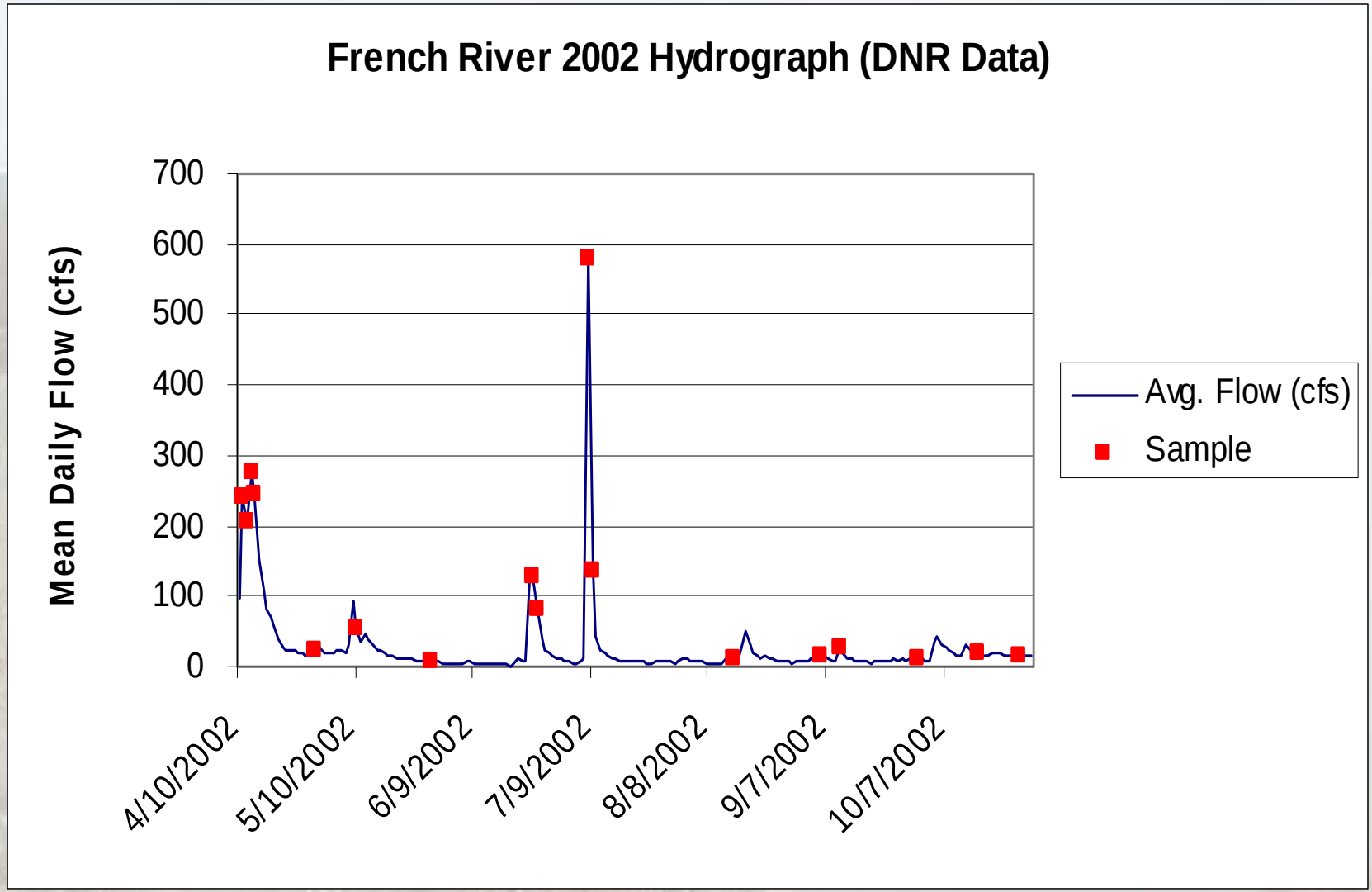

St. Louis County
Lake County
Cook County
Brule River
Grand Marais
Poplar River
Two Harbors
Sucker River
French River
Talmadge R.
Amity Creek
Duluth
Sampling stations
North Shore streams
Lake Superior watersheds
Counties
N

Monitoring Procedure

- Standard, established protocol for assessing non-point source pollution
- Determine annual “loading” of nutrients and sediments (erosion)
- Continuous streamflow monitoring and statistically defined water quality sampling
- 20 samples annually
  - 75% @ high flow events (snowmelt, big rains)
- Computer model computes total loading rates (tons / year) and “flow weighted mean concentrations” based on relationship between flow and concentrations

Knife River After a Rain Storm

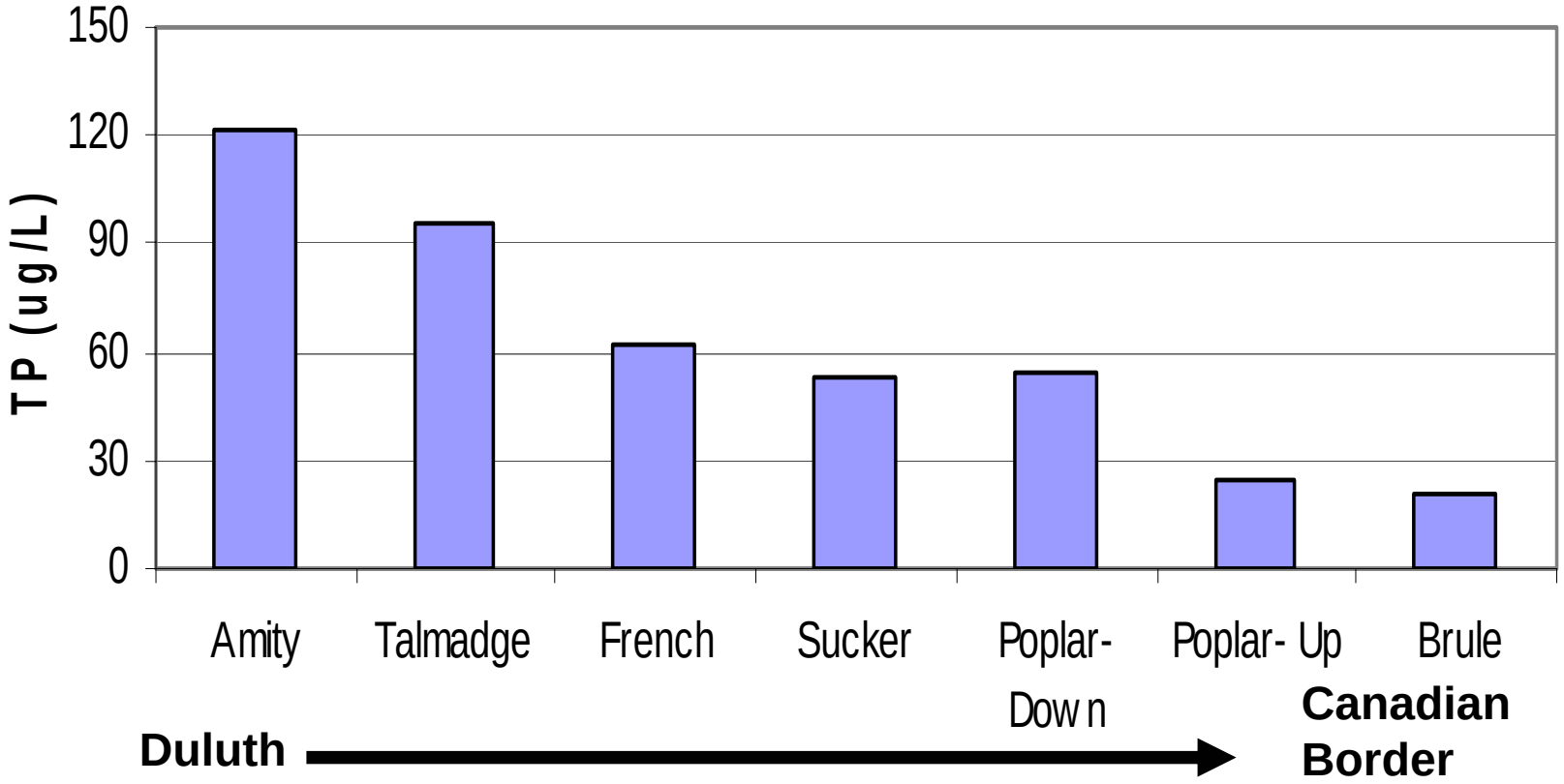
(Photo courtesy of St. Paul Pioneer Press)


French River 2002 Hydrograph (DNR Data)
Mean Daily Flow (cfs)
700
600
500
400
300
200
100
0
4/10/2002
5/10/2002
6/9/2002
7/9/2002
8/8/2002
9/7/2002
10/7/2002
Avg. Flow (cfs)
Sample

Findings

- Sediment and nutrient levels were highest in the Duluth – Two Harbors Region, water quality improved farther up the Shore
  - Landuse change (development)
  - Natural watershed differences
- High flow events contribute most pollution
- Water quality impacts in the Poplar River
- Water quality declined since the 1970's, except in relatively pristine Brule River

2002 Flow Weighted Mean Concentration- Total Phosphorus



Excessive Nutrients = Excessive Algae Levels

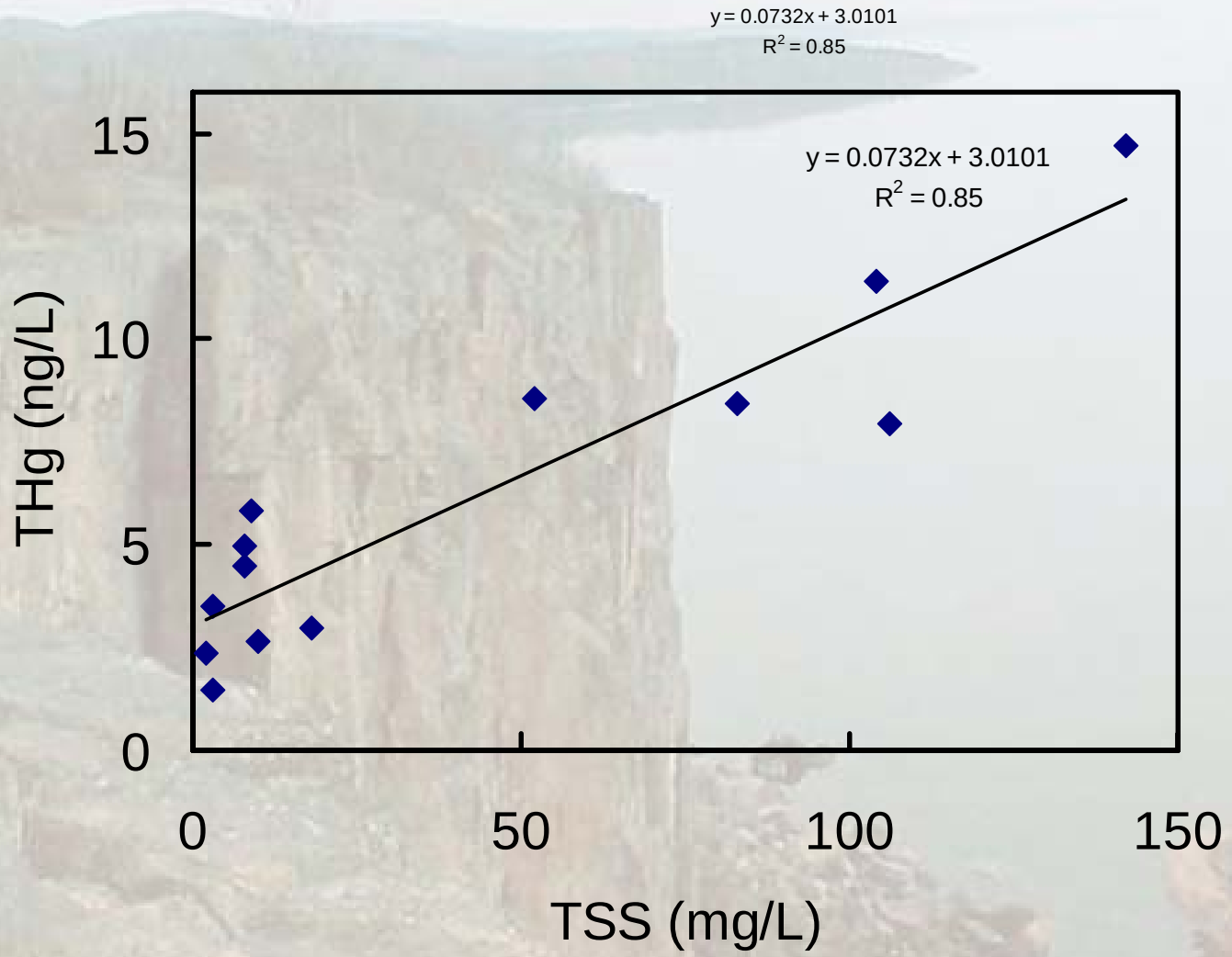
Poplar- Upstream site after significant rainfall, 7/30/01

- Total Suspended Solids = 2.4 mg/L
- Turbidity = 2.8 NTU
- Total Phosphorus = .013 mg/L

Poplar Downstream site after significant rainfall, 7/30/01

- Total Suspended Solids = 370 mg/L
- Turbidity = 890 NTU
- Total Phosphorus = .549 mg/L

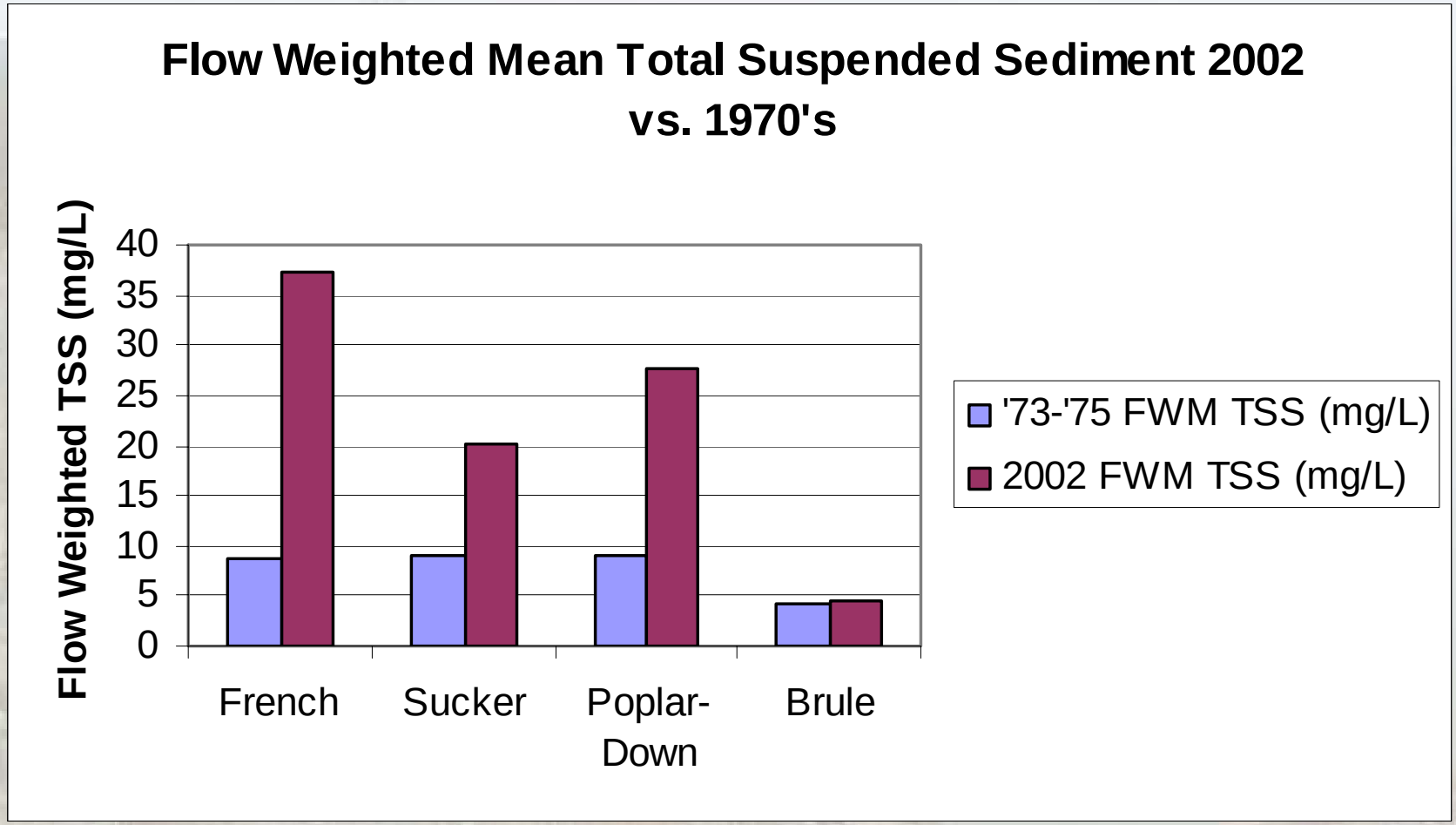
Total Mercury vs. TSS in the Poplar River, 2002



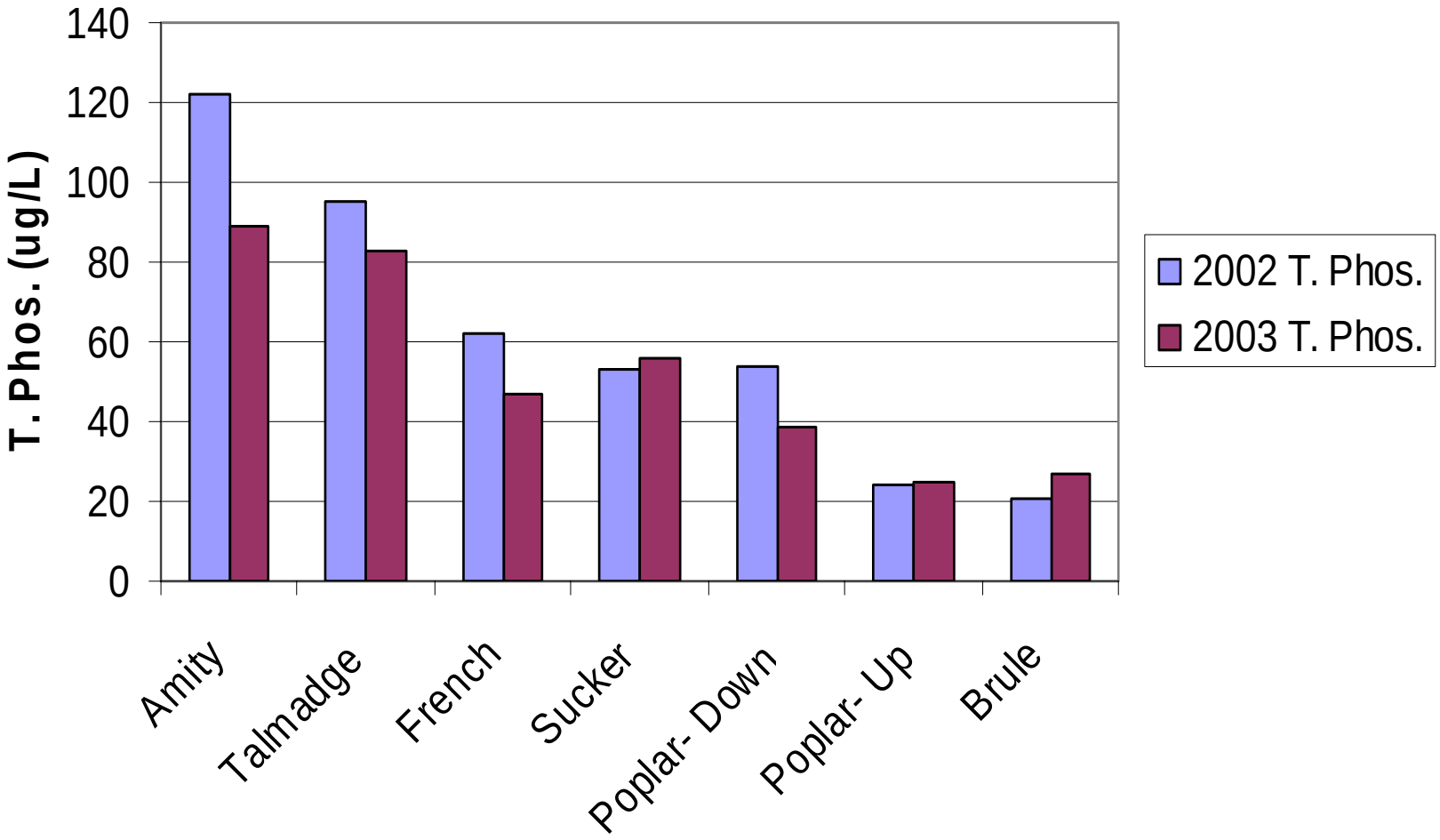
Mercury Sampling in the Poplar River, 2002

- Strong correlation between Hg and TSS
  - Found in other river basins by S. Balogh @ MCES
- Sediment sources are Hg sources
- Mercury levels exceed State standard at both sites
- Implications to fisheries / fish consumption advisory?

Water Quality Trends



2002 and 2003 Flow Weighted Mean Total Phosphorus Concentrations



Take Home Messages

- NS Streams are sensitive resources, tied to quality of tourism experiences
- NS Streams have responded to landuse changes, evident water quality impacts

- Monitoring must continue, requires a strong commitment of many agencies.
  - Good information yields good water management decisions

Acknowledgements

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